National Advisory Committee for Aeronautics

Research Abstracts and Reclassification Notice

NO. 122 DECEMBER 3, 1957

SPECIAL NOTICE

All NACA publications that were issued under the following series designations are now declassified:

NACA ACR (Advance Confidential Report)
NACA ARR (Advance Restricted Report)
NACA CB (Confidential Bulletin)
NACA RB (Restricted Bulletin)
NACA MR (Memorandum Report)

None of these series designations is currently used; the last publications designated by them were issued in 1947.

All NACA Research Memorandums with 1946 code numbers (such as E6B12) are now declassified.

The declassification of each publication in these groups has been previously announced. The present announcement is made for the benefit of those who may not have access to all of the individual announcements.

CURRENT NACA RESEARCH REPORTS

NACA Rept. 1309

AERODYNAMIC CHARACTERISTICS AT HIGH SPEEDS OF RELATED FULL-SCALE PROPELLERS HAVING DIFFERENT BLADE-SECTION CAMBERS. Julian D. Maynard and Leland B. Salters, Jr. 1957. ii, 24p. diagrs., photos., tab. (NACA Rept. 1309. Supersedes RM L8E06)

Comparisons are made of results obtained in wind-tunnel tests of related full-scale propellers over a range of blade angles from 20° to 55° at airspeeds up to 500 miles per hour to evaluate the combined effects of blade-section camber and compressibility on propeller aerodynamic characteristics.

NACA RM E57G11

ACCELERATION IN FIGHTER-AIRPLANE CRASHES. Loren W. Acker, Dugald O. Black, and Jacob C. Moser. November 1957. 78p. diagrs., photos. (NACA RM E57G11)

Full-scale crashes were conducted with FH-1 jet fighter airplanes under circumstances approximating those observed in the military service. These crashes simulated unflared landings at impact angles of 18°, 22°, and 27°, a ground cart wheel, and a ground loop. The magnitude, duration, and direction of the crash accelerations were measured on the airplane structure and on an anthropomorphic dummy installed in the cockpit. The accelerations measured are compared with existing data on human tolerance to the sudden loads that occur in crashes to see whether the human tolerance had been exceeded.

NACA RM E57G16a

THEORETICAL ROCKET PERFORMANCE OF JP-4 FUEL WITH SEVERAL FLUORINE-OXYGEN MIXTURES ASSUMING FROZEN COMPOSITION. Sanford Gordon and Kenneth S. Drellishak. November 1957. 62p. diagrs., tabs. (NACA RM E57G16a)

Data were calculated for a chamber pressure of 600 pounds per square inch absolute, fluorine in oxidant from 0 to 100 percent, pressure ratios of 1 to 1500, and a range of equivalence ratios. Parameters included are specific impulse, combustion and exit temperatures, molecular weight, characteristic velocity, coefficient of thrust, area ratio, specific heat, isentropic exponent, viscosity, thermal conductivity, and combustion composition.

NACA TN 4046

A COMPARATIVE ANALYSIS OF THE PERFORMANCE OF LONG-RANGE HYPERVELOCITY VEHICLES. Alfred J. Eggers, Jr., H. Julian Allen, and Stanford E. Neice. October 1957. (i), 66p. diagrs. (NACA TN 4046. Supersedes RM A54L10)

A simplified analysis is made of the motion and aerodynamic heating of long-range ballistic-, skip-, and glide-type vehicles. The ballistic vehicle appears relatively attractive because convective heat transfer can be reduced by using blunt shapes. The glide vehicle appears attractive because it has a relatively efficient trajectory, and the possibility of substantial radiative cooling. These vehicles compare favorably, in the sense of the Brequet range equation, to the supersonic airplane for very long-range flight.

CURRENT NACA RESEARCH REPORTS

NACA TN 4047

A STUDY OF THE MOTION AND AERODYNAMIC HEATING OF MISSILES ENTERING THE EARTH'S ATMOSPHERE AT HIGH SUPERSONIC SPEEDS. H. Julian Allen and A. J. Eggers, Jr. October 1957. 61p. diagrs. (NACA TN 4047. Supersedes RM A53D28)

A simplified analysis of the velocity and deceleration history of missiles entering the earth's atmosphere at high supersonic speeds is presented. The results of this motion analysis are employed to indicate means available to the designer for minimizing aerodynamic heating. The heating problem considered involves not only the total heat transferred to a missile by convection, but also the maximum average and local time rates of convective heat transfer.

NACA TN 4048

MOTION OF A BALLISTIC MISSILE ANGULARLY MISALINED WITH THE FLIGHT PATH UPON ENTERING THE ATMOSPHERE AND ITS EFFECT UPON AERODYNAMIC HEATING, AERODYNAMIC LOADS, AND MISS DISTANCE. H. Julian Allen. October 1957. 66p. diagrs., tabs. (NACA TN 4048. Supersedes RM A56F15)

An analysis is given of the oscillating motion of a ballistic missile which upon entering the atmosphere is angularly misalined with respect to the flight path. The history of the motion for some example missiles is discussed from the point of the effect of the motion on the aerodynamic heating and loading. The miss distance at the target due to misalinement and to small accidental trim angles is treated. The stability problem is also discussed for the case where the missile is tumbling prior to atmospheric entry.

NACA TN 4087

DROP-SIZE DISTRIBUTION FOR CROSSCURRENT BREAKUP OF LIQUID JETS IN AIRSTREAMS. Robert D. Ingebo and Hampton H. Foster. October 1957. 36p. diagrs., photos. tabs. (NACA TN 4087)

Photographic and sampling techniques were combined to obtain drop-size data for ranges of injector, liquid, and airstream variables. The following empirical expression correlated the ratio of volume-median diameter D_{30} to orifice diameter D_o with Weber-Reynolds number ratio $D_{30}/D_o = 3.9(We/Re)^{0.25}$ where $We = \sigma/\rho_s D_o V_s^2$, $Re = D_o V_s/\nu$, σ and ν are surface tension and kinematic viscosity, respectively, of the liquid; and V_s and ρ_s are free-stream velocity and density, respectively, of the air. A drop-size-distribution equation based on maximum observed drop diameter and Weber-Reynolds number ratio was also derived.

$$\frac{dR}{dD} = 10^6\left(\frac{We}{Re}\right)^{0.24} \frac{D^5}{D_{max}^6} e^{-22.3(We/Re)^{0.04}D/D_{max}}$$

NACA TN 4097

INVESTIGATION OF SOME MECHANICAL PROPERTIES OF THERMENOL COMPRESSOR BLADES. Donald F. Johnson. October 1957. 14p. diagrs., photo. (NACA TN 4097)

A series of tests were made comparing the mechanical properties of similar compressor blades of AISI type 403 stainless steel and thermenol. Eighth-stage J47 and J65 compressor blades of each material were tested. Modulus of elasticity, modulus of rigidity, and damping were slightly lower for thermenol. However, thermenol showed better resistance to corrosion by sea water, and the thermenol blades proved equal or superior to the stainless-steel blades in fatigue strength.

NACA TN 4124

EFFECT OF GROUND PROXIMITY ON THE AERODYNAMIC CHARACTERISTICS OF A FOUR-ENGINE VERTICAL-TAKE-OFF-AND-LANDING TRANSPORT-AIRPLANE MODEL WITH TILTING WING AND PROPELLERS. William A. Newsom, Jr. October 1957. 15p. diagrs., photo., tab. (NACA TN 4124)

An investigation was conducted on an airplane model with the wing at an angle of incidence of 90^o for a range of heights of the model above the ground and included force tests and tuft studies of the flow field caused by the propeller slipstream. The results indicate that, when the model was hovering near the ground, there was a strong upwash in the plane of symmetry which caused both an increase in lift because of the up load on the fuselage and an increase in the nose-down pitching moment because the rear part of the fuselage was longer than the front part.

NACA TN 4129

ANALYSIS OF OPERATIONAL AIRLINE DATA TO SHOW THE EFFECTS OF AIRBORNE WEATHER RADAR ON THE GUST LOADS AND OPERATING PRACTICES OF TWIN-ENGINE SHORT-HAUL TRANSPORT AIRPLANES. Martin R. Copp and Walter G. Walker. November 1957. 18p. diagrs., tabs. (NACA TN 4129)

Airspeed, altitude, and acceleration data were obtained from transports flown by one airline before and subsequent to the installation of airborne weather radar. A comparison of the results indicated that the magnitudes of the largest gust velocities and gust accelerations experienced for a given number of flight miles during radar operations were approximately 25 percent less than those experienced before the radar equipment was installed.

CURRENT NACA RESEARCH REPORTS

NACA TN 4130

NACA 65-SERIES COMPRESSOR ROTOR PERFORMANCE WITH VARYING ANNULUS-AREA RATIO, SOLIDITY, BLADE ANGLE, AND REYNOLDS NUMBER AND COMPARISON WITH CASCADE RESULTS. Wallace M. Schulze, John R. Erwin, and George C. Ashby, Jr. October 1957. 62p. diagrs., photos., tab. (NACA TN 4130. Supersedes RM L52L17)

An axial-flow compressor rotor was tested at low speed and without guide vanes or stators in a 28-inch test compressor. The rotor was designed for a free-vortex type blade loading using NACA 65-series 10-percent-thick airfoil sections. In these tests, the effects of changes of blade-setting angle, annulus-area ratio, solidity, and Reynolds number on rotor performance were determined for a range of quantity flows. Rotor data are compared with estimations based on uncorrected and corrected cascade data.

NACA TN 4132

FATIGUE INVESTIGATION OF FULL-SCALE TRANSPORT-AIRPLANE WINGS. VARIABLE-AMPLITUDE TESTS WITH A GUST-LOADS SPECTRUM. Richard E. Whaley. November 1957. 43p. diagrs., photos., tabs. (NACA TN 4132)

Crack-initiation areas, frequency of occurrence of cracks, crack propagation, lifetime to crack initiation of all cracks, lifetime to final failure, and spread in lifetime are investigated and compared with results from constant-amplitude tests on similar wings. Information on X-ray techniques to determine the presence of cracks in hidden elements is also included.

NACA TN 4143

DEVELOPMENT OF A PISTON-COMPRESSOR TYPE LIGHT-GAS GUN FOR THE LAUNCHING OF FREE-FLIGHT MODELS AT HIGH VELOCITY. A. C. Charters, B. Pat Denardo, and Vernon J. Rossow. November 1957. (i), 95p. diagrs., photos., tabs. (NACA TN 4143. Supersedes RM A55G11)

A light-gas gun has been developed at the Ames Aeronautical Laboratory to launch small models for aerodynamic tests. The design of the gun and the analysis of its performance are presented. The results of the initial firing trials are discussed. The firing trials showed good agreement between measured and predicted velocities and pressures and a velocity of 15,400 ft/sec was reached. It is concluded that the gun is a satisfactory launcher for high-velocity free-flight tests.

NACA TN 4156

EFFECT OF INITIAL MIXTURE-TEMPERATURE ON BURNING VELOCITY OF HYDROGEN-AIR MIXTURES WITH PREHEATING AND SIMULATED PREBURNING. Sheldon Helmel. October 1957. 23p. diagrs., tabs. (NACA TN 4156)

Laminar burning velocities were determined in the temperature range 300° to 700° K from schlieren photographs of open flames. The temperature was raised in two ways: (1) by preheating of the hydrogen-air mixtures and (2) by simulated adiabatic preburning of part of the hydrogen in air at 300° K so that initial temperatures of 600° and 700° K would be attained for the resulting mixtures of hydrogen, air, water vapor, and nitrogen. The temperature dependence of burning velocity was determined for both preheated and preburned mixtures. With 29.6 and 45.0 percent hydrogen (original mixture), mole-for-mole substitution of nitrogen for water vapor in the preburning experiments caused no discernible change in burning velocity.

NACA TN 4162

STUDY OF SOME BURNER CROSS-SECTION CHANGES THAT INCREASE SPACE-HEATING RATES. Donald R. Boldman and Perry L. Blackshear, Jr. November 1957. 38p. diagrs., photos., tab. (NACA TN 4162)

A two-dimensional glass-walled combustor fed with a homogeneous combustible mixture was used to study the effect of area blockage on heat release. The blockage at a single V-gutter flame holder was varied from 12.5 to 75 percent with negligible effect on combustion efficiency. When a small flame holder was used and a 62.5-percent restriction introduced downstream, the heat-release rate underwent a three- to fourfold increase. Some effects of downstream blockage shapes are given.

NACA TN 4167

A RAPID METHOD FOR PREDICTING ATTACHED-SHOCK SHAPE. Eugene S. Love and Ronald H. Long. October 1957. 34p. diagrs., tab. (NACA TN 4167)

A method is presented for the rapid prediction of the shape of attached shocks emanating from smoothly contoured axisymmetric and two-dimensional nose shapes. From a practical viewpoint the accuracy of the method is comparable to that of the method of characteristics.

CURRENT NACA RESEARCH REPORTS

NACA TN 4169

ATMOSPHERIC TEMPERATURE OBSERVATIONS TO 100,000 FEET FOR SEVERAL CLIMATOLOGICAL REGIONS OF THE NORTHERN HEMISPHERE. H. B. Tolefson. November 1957. 26p. diagr., tab. (NACA TN 4169)

Radiosonde measurements of upper-air temperatures taken over a 5-year period at nine stations in the northern hemisphere are summarized in tabular form in order to provide information on the temperatures likely to be encountered during airplane and missile operations up to 100,000 feet. The results indicate that the scatter in the temperatures about the mean generally decreased with increasing altitude from the tropopause to 100,000 feet. Little, if any, effect of location upon the temperature was apparent for altitudes above about 90,000 feet.

NACA TN 4171

SOME GROUND MEASUREMENTS OF THE FORCES APPLIED BY PILOTS TO A SIDE-LOCATED AIRCRAFT CONTROLLER. Roy F. Brissenden. November 1957. 17p. diagrs., photos., tab. (NACA TN 4171)

Ground tests have been made to determine pilots' force capabilities on a proposed side-located aircraft controller. In addition to maximum force capabilities, pilots participating in the tests indicated forces that they considered desirable for operation of the controller. A neutral position and a range of deflections and forces are suggested.

NACA TN 4174

WIND-TUNNEL INVESTIGATION OF THE STATIC LATERAL STABILITY CHARACTERISTICS OF WING-FUSELAGE COMBINATIONS AT HIGH SUBSONIC SPEEDS. TAPER-RATIO SERIES. James W. Wiggins and Paul G. Fournier. October 1957. 25p. diagrs., photos. (NACA TN 4174. Supersedes RM L53B25a)

This paper presents the aerodynamic characteristics in sideslip of wing-fuselage combinations. The wings have a sweep angle of 45° at the quarter-chord line, aspect ratio of 4, taper ratios of 0.3, 0.6, and 1.0, and an NACA 65A006 airfoil section. The tests covered a Mach number range from 0.4 to 0.95, a Reynolds number range from 1.7×10^6 to 3.2×10^6, and an angle-of-attack range from -3° to 24°.

NACA TN 4175

INVESTIGATION OF DEFLECTORS AS GUST ALLEVIATORS ON A 0.09-SCALE MODEL OF THE BELL X-5 AIRPLANE WITH VARIOUS WING SWEEP ANGLES FROM 20° TO 60° AT MACH NUMBERS FROM 0.40 TO 0.90. Delwin R. Croom and Jarrett K. Huffman. November 1957. 28p. diagrs. (NACA TN 4175)

An investigation has been made in the Langley high-speed 7- by 10-foot tunnel to determine the effectiveness of deflectors as gust alleviators on a 0.09-scale model of the Bell X-5 research airplane with wing sweep angles from 20° to 60°. Results of this study have indicated that a deflector arrangement can be used as a gust-alleviation device on swept wings.

BRITISH REPORTS

N-50049*

Royal Aircraft Establishment (Gt. Brit.)
SOME METHODS OF EVALUATING IMPERFECT GAS EFFECTS IN AERODYNAMIC PROBLEMS. G. A. Bird. January 1957. 31p. diagrs. RAE Tech. Note Aero 2488. (Ask for N-50049*)

Simple numerical and graphical procedures are described for the calculation of the imperfect gas effects on the properties of steady and unsteady one-dimensional isentropic flows, the Prandtl-Meyer expansion round a corner and normal and oblique shock waves. The fundamental equations of each type of flow have been put into a form in which they may be solved using the published tables of the equilibrium properties of gases. Both thermal and caloric imperfections have been taken into account but relaxation time effects have been neglected. Numerical examples are given for each type of flow although the main emphasis has been placed on the methods rather than on the results. These basic methods have been used to calculate the magnitude of the imperfect gas effects on a number of specific aerodynamic problems which have been considered in detail.

N-50128*

Royal Aircraft Establishment (Gt. Brit.)
METHODS FOR DETERMINING THE WAVE DRAG OF NON-LIFTING WING-BODY COMBINATIONS. L. M. Sheppard. April 1957. 39p. diagrs. RAE Aero 2590. (Ask for N-50128*)

The area rule, moment of area rule, and transfer rule methods for estimating the wave drag of wing-body combinations are discussed. It is pointed out that the moment of area rule and the transfer rule are different forms of the area rule, and that the transfer rule expresses the interference wave drag in a simple form. The existing methods of wave drag estimation are restricted to combinations with bodies having continuous surface slope and here an extension to combinations with bodies having discontinuous surface slope is given. This paper is concerned with the theoretical methods and their associated numerical techniques and no numerical results or particular applications are presented.

* AVAILABLE ON LOAN ONLY

BRITISH REPORTS

N-50129*

Ministry of Supply (Gt. Brit.)
THE SULFINUZ TREATMENT OF S.80 AND S.99 STEELS, EFFECT ON FATIGUE STRENGTH AND OTHER PROPERTIES. July 1957. 15p. diagrs., photos., tabs. MOS S & T Memo. 9/57.
(Ask for N-50129*)

Tensile, Izod impact, fatigue and corrosion tests have been carried out on two steels treated by the "SULFINUZ" process. A significant improvement in fatigue strength is noted when compared with steels treated in a neutral salt bath. Under severe corrosive conditions the "SULFINUZ" treated specimens show greater attack with marked local action. A preliminary metallographic examination is described.

N-50131*

Royal Aircraft Establishment (Gt. Brit.)
THE SHRINKAGE AND EXTENSIBILITY OF HEATED YARNS. PART 1. J. E. Swallow. March 1957. 22p. diagrs. RAE Tech. Note Chem. 1302.
(Ask for N-50131*)

The changes in length which occur when nylon, Terylene and Fortisan yarns are heated, and the reversibility of these changes, are described. The effects of stress on yarns which have been heated are considered. It is shown that stressing may reduce the dimensional stability conferred by heat-setting.

N-50132*

Royal Aircraft Establishment (Gt. Brit.)
FACTORS AFFECTING THE THERMAL STABILITY OF POLYESTER GLASS-FIBRE LAMINATES. B. A. Blythe and W. W. Wright. April 1957. 20p. diagrs., tabs. RAE Tech. Note Chem. 1306.
(Ask for N-50132*)

The effects of variation of glass cloth, glass-cloth treatment, and initiator for the polymerization reaction on the flexural strength at elevated temperatures of polyester glass-fiber laminates have been studied. The strengths of high- and low-alkali glass-cloth laminates were comparable. The use of treated glass cloths resulted in improved initial strength and strength retention with time; this was especially true of the Garan finish. Variation of the initiator used for the curing reaction, although resulting in a wide variation of the flexural strength values after particular times at temperature, appeared to have little effect on the characteristics of the thermal breakdown. The variations in flexural strength of laminates made using 10 heat-resistant laminating resins were determined with time at elevated temperature. Very good results were obtained with a phenolic resin.

N-50134*

Royal Aircraft Establishment (Gt. Brit.)
THE GEOMETRY OF WING SURFACES GENERATED BY STRAIGHT LINES AND WITH A HIGH RATE OF THICKNESS TAPER AT THE ROOT. D. Peckham. May 1957. 17p. diagrs. RAE Tech. Note Aero 2451. (Ask for N-50134*)

This note describes a way in which wings can be designed to have a high rate of thickness taper at the root, while still maintaining a surface shape generated by straight lines. The method can be most successfully applied to wings of parabolic arc section straight-tapered plan form, in which case there is no change in airfoil section shape across the span. Other plan-form shapes, and wing root airfoil section shapes, result in a variation of airfoil section shape across the span.

N-50143*

Royal Aircraft Establishment (Gt. Brit.)
HOUSINGS FOR STANDARD AIRBORNE ELECTRIC MOTORS. Z. R. S. Ratajski. March 1957. 25p. diagrs. RAE Tech. Note EL. 135.
(Ask for N-50143*)

This Technical Note discusses the present position on the standardization of housings for small d-c and a-c airborne motors and gives details of the modern, clamp-mounted cylindrical housings already used for a number of servo-components and motors. Reference is made to American Standards and proposals, including those of the Society of Automotive Engineers, Inc. (U.S.A.), for commercial airborne motors. It is recommended that the clamp-mounted cylindrical housing should be adopted as standard for the whole range of small airborne d-c and a-c motors.

N-50144*

Royal Aircraft Establishment (Gt. Brit.)
BRIEF LANDING TRIALS USING THE FLUSH LIGHTING PATTERN IN THE RUNWAY AT THE ROYAL NETHERLANDS AIR FORCE STATION AT SOESTERBERG. E. N. Hooton. March 1957. 20p. diagrs. RAE Tech. Note. BL. 45.
(Ask for N-50144*)

At the Royal Netherlands Air Force airfield at Soesterberg a center line and cross bar approach lighting pattern is installed within the runway flush with the runway surface. Brief flight tests have been made using Varsity and Devon aircraft to examine the visual guidance provided by this approach pattern during final flare and landing. Although, in detail, far from ideal for such a purpose, the provision of a pattern within the runway was considered to be a great improvement on runway edge lighting by three of the four pilots who took part in the tests. The results in general confirm ground simulator tests and indicate certain elements essential to any visual guidance system for landing.

BRITISH REPORTS

N-50145*

Royal Aircraft Establishment (Gt. Brit.) FATIGUE LOADINGS IN FLIGHT-LOADS IN THE TAILPLANE OF A COMET I. Anne Burns. March 1957. 19p. diagrs., photo., tabs. RAE Tech.Note Structures 222. (Ask for N-50145*)

Data are presented on the number of load cycles of various magnitudes occurring in the tailplane of a Comet IA during normal ground and flight conditions. The conditions include flight in turbulence, take-off, landing, taxiing, and ground running of the engine. The relative importance of the loads in the different conditions is illustrated by reference to the loads in a typical flight.

MISCELLANEOUS

Errata on NACA Rept. 1295, by Rogallo, Yaggy, and McCloud, III. 1956.

Errata on NACA RM L55L23b, by Hill, Adamson, Foland, and Bressette. March 26, 1957.

Errata on NACA TN 3176, by Baldwin, Jr., Turner, and Knechtel. May 1954.

Errata on NACA TN 3433, by Cunningham. May 1955.

UNPUBLISHED PAPERS

N-55837*

Battelle Memorial Institute. THE EFFECT OF VARIATIONS IN MELTING AND CASTING PROCEDURE ON THE STRUCTURE AND HIGH-TEMPERATURE PROPERTIES OF CAST X-40 ALLOY. E. E. Fletcher, H. J. Hucek, A. R. Elsea, and G. K. Manning. January 16, 1957. (iii), 59p. diagrs., photos., tabs. Battelle Memorial Inst. (Ask for N-55837*)

Melting and pouring atmospheres, such as vacuum, which lowered the nitrogen content of X-40 alloy below some minimum value (approximately 0.05 to 0.07 percent) markedly reduced the high-temperature strength of the alloy. The loss of other elements during melting had a relatively minor effect on the properties. Variations in pouring temperature over the range of 2650° to 2850° F had little effect on the properties. Of the three mold preheat temperatures studied (300°, 1600°, and 1900° F), castings made in 1900° F molds yielded the best and most consistent high-temperature properties. No consistent relationship between microstructure and high-temperature properties was observed; however, there were indications that castings with an intermediate grain size were stronger than those with either extremely coarse or fine grain sizes. The high-temperature bend test was found to be unsuitable as a screening test for stress-rupture properties, but it appeared to be useful for evaluating deformation or creep characteristics.

N-55838*

Battelle Memorial Institute. THE EFFECTS OF VARIATIONS IN NITROGEN AND MANGANESE CONTENT ON THE STRUCTURE AND HIGH-TEMPERATURE PROPERTIES OF CAST X-40 ALLOY. E. E. Fletcher, H. J. Hucek, A. R. Elsea, and G. K. Manning. June 14, 1957. 32p. diagrs., photos., tabs. Battelle Memorial Inst. (Ask for N-55838*)

N-55839*

Polytechnic Institute of Brooklyn. ON SOME EXACT SOLUTIONS OF LAMINAR MIXING IN THE PRESENCE OF AXIAL PRESSURE GRADIENTS. Luigi G. Napolitano. December 1955. 22p. Polytechnic Inst. of Brooklyn. PIBAL Report 302. (Ask for N-55839*)

The well-known power and exponential velocity distributions in the Stewartson plane are shown to still yield similar solutions in the case of compressible mixing provided an additional requirement, concerning the Mach number distributions of the two streams, is satisfied. Analysis of the corresponding incompressible problem shows that no similar solutions are possible except for the simplest case of zero pressure gradient. For the mixing of two uniform streams the ordinary differential equation giving the similar solutions is shown to reduce to the Blasius equation in both the compressible and the incompressible cases. Consequently with this approach the time-consuming iteratton process which arises in the previously given methods of analysis is eliminated. The possibility of a rapid investigation of temperature effect on wake characteristics is stressed.

N-55840*

Polytechnic Institute of Brooklyn. EXPERIMENTAL INVESTIGATION OF THE MIXING OF TWO HOMOGENEOUS STREAMS IN CHANNELS OF GIVEN GEOMETRY. Luigi G. Napolitano and Marian Visich, Jr. January 1957. 88p. diagrs., photos. Polytechnic Inst. of Brooklyn. PIBAL Report 321. (Ask for N-55840*)

Four series of tests were performed in a constant area channel, each series being characterized by a value of the Mach number of stream A and a value of the height of stream B at the origin of mixing. $M = 1.6$ and 2.5; the heights of stream B at the origin of mixing were equal to 1 and 2 inches. Two additional series of tests were performed in a variable area channel at $M = 2.5$ for the two previously mentioned heights of stream B. Overall characteristics of mixing process are presented in terms of static pressure distributions along the channel, Mach

UNPUBLISHED PAPERS

number profiles at the discharge end, static pressures at the origin of mixing, and schlieren photographs of relevant flow patterns. Effects of several parameters are discussed and a correlation of some of the experimental data is presented. Applications of the results to some practical problems such as supersonic ejector design and base bleed are outlined.

DECLASSIFIED NACA RESEARCH REPORTS

This is authority for those possessing copies of the following research reports to declassify them from Confidential. Items marked (#) are UNAVAILABLE since they contain obsolete or proprietary information. Effective date of declassification November 8, 1957.

#NACA MR L6G12a, by Gilman and Harman (5321 Army-Navy UPA-11/1)

NACA RM A53K20

INVESTIGATION OF A TRAILING-EDGE PADDLE-CONTROL SURFACE ON A TRIANGULAR WING OF ASPECT RATIO 2 AT SUBSONIC AND SUPERSONIC SPEEDS. Louis H. Ball. February 1954. 18p. diagrs., tab. (NACA RM A53K20)

This report presents the results of an experimental investigation of external airfoils known as paddle-control surfaces as the longitudinal control device on a triangular wing of aspect ratio 2. The lift, drag, pitching moment, and hinge moment were obtained for Mach numbers of 0.60, 0.80, 0.90, 1.20, 1.30, 1.50, 1.70, and 1.90 at a constant Reynolds number of 3.0×10^6, for angles of attack from about -4° to 18° and for paddle-control deflections from approximately 4° to -16°.

NACA RM A54K09

LONGITUDINAL STABILITY CHARACTERISTICS AT MACH NUMBERS UP TO 0.92 OF A WING-BODY-TAIL COMBINATION HAVING A WING WITH 45° OF SWEEPBACK AND A TAIL IN VARIOUS VERTICAL POSITIONS. Jack D. Stephenson, Angelo Bandettini, and Ralph Selan. January 1955. 64p. diagrs., photos., tabs. (NACA RM A54K09)

Data are presented showing lift, drag, and static longitudinal stability characteristics of a wing-body-tail combination having a 45° sweptback wing with an aspect ratio of 5.5. Lowering the horizontal tail to the wing chord plane extended resulted in significant improvements in the stability of the model both with an unmodified wing and with fences or chord extensions on the wing.

NACA RM E9K29

ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF THRUST AUGMENTATION OF AXIAL- AND CENTRIFUGAL-COMPRESSOR TURBOJET ENGINES BY INJECTION OF WATER AND ALCOHOL IN COMBUSTION CHAMBERS. David S. Gabriel, Harry W. Dowman, and William L. Jones. April 13, 1950. 43p. diagrs., photo. (NACA RM E9K29)

Thrust augmentation by injection of water and water-alcohol mixtures into combustion chambers was investigated at sea-level zero-ram conditions on axial- and centrifugal-flow turbojet engines. Thrust augmentation, compressor characteristics, fuel flow, and turbine-outlet-temperature distributions are presented for various injection rates and water-alcohol mixtures. A method of computing thrust augmentation produced by injection into the combustion chambers is presented. Computed augmented-thrust ratios were within 1 percent of the experimental results. Water injection into the centrifugal-flow engine produced little thrust augmentation.

#NACA RM SE50J12, by Cook and Butze

NACA RM E50K22

EXPERIMENTAL INVESTIGATION OF TAIL-PIPE-BURNER DESIGN VARIABLES. W. A. Fleming, E. William Conrad, and A. W. Young. March 5, 1951. 75p. diagrs., photos., tab. (NACA RM E50K22)

The results of several experimental tail-pipe-burner investigations at the NACA Lewis Laboratory are summarized to indicate the effects of tail-pipe-burner design variables on performance and operating characteristics. Most of the configurations were operated over wide ranges of altitudes and flight Mach numbers. The data indicate the effect of changes in principal design variables, such as flame-holder type, burner length, burner diameter, and fuel distribution on performance, and indicate the features of a tail-pipe burner that will operate with high combustion efficiency up to an altitude of approximately 50,000 feet.

NACA RM E51A25

INVESTIGATION OF ALTITUDE IGNITION, ACCELERATION AND STEADY-STATE OPERATION WITH SINGLE COMBUSTOR OF J47 TURBOJET ENGINE. William P. Cook and Helmut F. Butze. March 5, 1951. 35p. diagrs., photo., tab. (NACA RM E51A25)

Satisfactory ignition was obtained with a J47 single combustor up to and including an altitude of 40,000 feet at conditions simulating equilibrium windmilling of the engine at flight speed of 400 miles per hour. At 30,000 feet, excess temperature rise available for combustion was limited by the ability of the combustor to provide temperature rise, whereas at high engine speeds the maximum allowable turbine-inlet temperature became the restricting factor.

DECLASSIFIED NACA RESEARCH REPORTS

Altitude operational limits increased from about 51,500 feet at 55-percent rated speed to about 64,500 feet at 85-percent rated speed. Combustion efficiencies varied from 39.0 to 92.6 percent.

#NACA RM E51K06, by Prince and Wintler

NACA RM E51K20

ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF INLET-ENGINE MATCHING FOR TURBOJET-POWERED AIRCRAFT AT MACH NUMBERS UP TO 2.0. Carl F. Schueller and Fred T. Esenwein. February 1952. 31p. diagrs., photos. (NACA RM E51K20)

An analysis of inlet-turbojet-engine matching for a range of Mach numbers up to 2.0 indicates large performance penalties when fixed-geometry inlets are used. Use of variable-geometry inlets, however, nearly eliminates these penalties. The analysis was confirmed experimentally by investigating at Mach numbers of 0, 0.63, and 1.5 to 2.0 two single oblique-shock-type inlets of different compression-ramp angles, which simulated a variable-geometry configuration. The experimental investigation indicated that total-pressure recoveries comparable with those attainable with well designed nose inlets were obtained with the side inlets when all the boundary layer ahead of the inlets was removed. Serious drag penalties resulted at a Mach number of 2.0 from the use of blunt-cowl leading edges. However, sharp-lip inlets produced large losses in thrust for the take-off condition. These thrust penalties which are associated with the low-speed operation of the sharp-lip inlet designs can probably be avoided without impairing the supersonic performance of the inlet by the use of auxiliary inlets or blow-in doors.

NACA RM E51K29

LOITERING AND RANGE PERFORMANCE OF TURBOJET-POWERED AIRCRAFT DETERMINED BY OFF-DESIGN ENGINE CYCLE ANALYSIS. Stanley L. Koutz and Reece V. Hensley. February 1952. 45p. diagrs., tab. (NACA RM E51K29)

The loitering and range performance of airplanes equipped with several different turbojet engines was analytically investigated by applying the results of off-design cycle analyses to specific airplane characteristics. The method of off-design cycle analysis is presented herein and is verified by a check with experimental data. For all engines considered, the loitering and the range fuel flows obtained with rated tail-pipe nozzle area, variable engine speed operation were within 2 or 3 percent of the optimum fuel flow obtainable with any method of engine operation. The optimum loitering altitude generally occurred between approximately 25,000 and 35,000 feet with corresponding optimum flight Mach numbers of 0.4 to 0.65. In general, the optimum range fuel flows occurred at 3000 to 5000 feet higher altitude and at approximately 0.15 higher flight Mach numbers than the optimum loitering fuel flow.

NACA RM E52K04

INTERNAL PERFORMANCE OF SEVERAL TYPES OF JET-EXIT CONFIGURATIONS FOR SUPERSONIC TURBOJET AIRCRAFT. William A. Fleming. January 1953. 28p. diagrs. (NACA RM E52K04)

Internal performance characteristics of a convergent nozzle, fixed convergent-divergent nozzles, an adjustable plug-type convergent-divergent nozzle, and jet ejectors were investigated over a wide range of pressure ratios. These data are summarized to provide an overall picture of jet-exit performance and thereby serve as an aid in selecting the most suitable jet-exit configurations for supersonic aircraft.

NACA RM E52K14

FORCE AND PRESSURE RECOVERY CHARACTERISTICS AT SUPERSONIC SPEEDS OF A CONICAL SPIKE INLET WITH BYPASSES DISCHARGING IN AN AXIAL DIRECTION. J. L. Allen and Andrew Beke. January 1953. 27p. diagrs., photos., tab. (NACA RM E52K14)

Force and pressure-recovery characteristics of a nacelle-type conical-spike inlet with two fixed-area bypasses are presented for flight Mach numbers of 1.6, 1.8, and 2.0 and for angles of attack from 0° to 9°. The inlet was designed to attain a mass-flow ratio of unity at a flight Mach number of 2.0. The horizontally opposed bypasses were 6 inlet diameters aft of the inlet entrance. At a flight Mach number of 2.0, the discharge of 23 percent of the critical mass flow of the inlet by means of bypasses (thus retaining critical inlet flow) increased the drag only one-fifth of the additive drag that would result if the same amount of air were spilled behind on inlet normal shock. The total-pressure recovery of the diffuser was not significantly reduced. Similar results were obtained at other flight Mach numbers.

NACA RM E52K17

PERFORMANCE OF DOUBLE-SHROUD EJECTOR CONFIGURATION WITH PRIMARY PRESSURE RATIOS FROM 1.0 TO 10. Donald P. Hollister and William K. Greathouse. February 1953. 34p. diagrs., tabs. (NACA RM E52K17)

A brief investigation was made to determine the performance characteristics of a double-shroud cooling-air ejector configuration. Two convergent primary nozzles were used to simulate a specific manufacturer's iris-type variable-area nozzle in the open and closed positions. The investigation comprised four phases: (1) obtained performance with no secondary or tertiary air flow (cooling-air passages blocked), (2) determining the tendency for backflow to occur in either cooling-air passage, (3) determining the sensitivity of flow in one passage to that in the other, and (4) obtaining pumping and thrust characteristics with secondary and tertiary

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air flow. The experimental results showed that the performance with the cooling-air passages blocked was typical of that for single ejectors having diameter and spacing ratios similar to those used in this investigation. There was a tendency for backflow to occur, but the magnitude of such flow was relatively small. The weight flow of each ejector was shown to be essentially independent of the other, and the closed primary-nozzle configuration was found to be generally capable of pumping more cooling air than the open primary-nozzle configuration. Gains in gross thrust were observed for both configurations, with losses occurring only at low secondary and tertiary pressure ratios.

NACA RM E52K18

INVESTIGATION AT SUPERSONIC SPEEDS OF AN INLET EMPLOYING CONICAL FLOW SEPARATION FROM A PROBE AHEAD OF A BLUNT BODY. Donald P. Hearth and Gerald C. Gorton. January 1953. 32p. diagrs., photos., tab. (NACA RM E52K18)

An experimental investigation was conducted on an inlet employing conical flow separation from a probe extending upstream from a hemispherical-nosed centerbody. Data were obtained at free-stream Mach numbers from 1.6 to 2.0 and angles of attack from 0° to 9°. Pressure-recovery and drag characteristics for the inlet were very nearly comparable with those for a conical-spike inlet at zero angle of attack and design Mach number of 2.0, but compared less favorably at Mach numbers below 2.0. A large reduction in pressure recovery and mass flow was obtained at angle of attack. However, an investigation on the use of probes offset from the inlet center line indicated that the angle-of-attack performance could be appreciably improved if the probe were alined with the stream direction.

NACA RM E52K26

ANALYSIS OF SEVERAL METHODS OF PUMPING COOLING AIR FOR TURBOJET-ENGINE AFTERBURNERS. John C. Samuels and Herbert Yanowitz. February 1953. 54p. diagrs. (NACA RM E52K26)

Several methods of pumping air to an annular cooling passage surrounding a typical axial-flow turbojet-engine afterburner were evaluated and compared on the basis of thrust and specific fuel consumption of the systems. Each system was analyzed over a range of afterburner-wall temperatures, flight Mach numbers, and exhaust-gas temperatures at sea level and 35,000 feet. Ram pressure recovery, boundary-layer pressure recovery, and the engine-jet actuated ejector appear to be satisfactory systems at high Mach numbers. Cooling with compressor-exit air bleed was found to be unsatisfactory, but the use of compressor-exit bleed air as the primary fluid in a high-performance ejector was satisfactory. The use of an auxiliary compressor driven from the engine shaft increased the thrust and decreased the specific fuel consumption of the engine for many of the conditions investigated.

NACA RM E53K03

ANALYSIS OF PERFORMANCE OF FOUR SYMMETRICAL-DIAGRAM-TYPE SUBSONIC INLET-STAGE AXIAL-FLOW COMPRESSORS. Robert J. Jackson. January 1954. 72p. diagrs., photos. (NACA RM E53K03)

The main results of an experimental investigation of four axial-flow single-stage compressors having a hub-tip radius ratio of 0.5 and designed for symmetrical velocity diagrams at all radii were as follows: Because of the action of radial equilibrium, the high-pressure-ratio and low-weight-flow type of design incurred high tip-region blade loadings and, consequently, high losses. Therefore, the most suitable use for the symmetrical-velocity-diagram type of design is for higher specific weight flow and (for a given Mach number limit) lower pressure ratio designs. A diffusion factor correlation was obtained, for a given solidity, among compressor and cascade-predicted deviation angles, and among compressor losses for the range of diffusion factor exceeding approximately 0.5. The available data indicated that the assumption of simplified radial equilibrium was a valid one. In order to predict the radial variation of air velocities, it was necessary to consider the radial variation of entropy, which was especially significant after the stators.

NACA RM E54I27a

PRELIMINARY INVESTIGATION OF THE STRENGTH AND ENDURANCE OF PLASTIC-IMPREGNATED FIBERGLASS COMPRESSOR BLADES. Donald F. Johnson and André J. Meyer, Jr. January 1955. 21p. diagrs., photos. (NACA RM E54I27a)

A complete set of third-stage compressor rotor blades fabricated from laminated fiberglass cloth and bonded with a phenolic resin were operated in a conventional engine for 105 hours. All blades were in perfect condition upon disassembly. Also, a number of laboratory tests were conducted on additional blades to determine moduli of elasticity and rigidity, strength in both tension and bending, internal damping, and the fatigue limit of the blade material.

NACA RM E54K02

PRELIMINARY INVESTIGATION OF A TECHNIQUE OF PRODUCING A HEATED CORE IN A SUPERSONIC WIND-TUNNEL STREAM. Morris D. Rousso and Milton A. Beheim. February 1955. 22p. photos., diagrs. (NACA RM E54K02)

An investigation conducted at Mach numbers 1.9 and 3.0 has shown that a central core of air of high stagnation temperature can be produced in the test section of a supersonic wind tunnel. Air heated by combustion was injected into the tunnel in a streamwise direction near the tunnel throat. The effects of core-nozzle location and dimensions, core to main air stream total-pressure ratio, and core stagnation temperature on the size and shape of temperature contours and on Mach number profiles in the test section were determined.

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NACA RM L8K04a

FLIGHT TESTS AT TRANSONIC AND SUPERSONIC SPEEDS OF AN AIRPLANE-LIKE CONFIGURATION WITH THIN STRAIGHT SHARP-EDGE WINGS AND TAIL SURFACES. Clarence L. Gillis and Jesse L. Mitchell. January 5, 1949. 37p. diagrs., photos., tab. (NACA RM L8K04a)

Rocket-powered models of a configuration having thin, straight, sharp-edge wings and tail surfaces were flight-tested at transonic and low supersonic speeds. Rather large longitudinal trim changes occurred. Decreased longitudinal control effectiveness was evident at supersonic speeds. The static directional stability appears adequate but a snaking oscillation generally existed at supercritical Mach numbers.

NACA RM L8K05

DRAG MEASUREMENTS IN FLIGHT ON THE 10-PERCENT-THICK AND 8-PERCENT-THICK WING X-1 AIRPLANES. John J. Gardner. November 19, 1948. 17p. diagrs., photo. (NACA RM L8K05)

Contains results of drag measurements of X-1 airplanes with 8-percent-thick wing, 6-percent-thick tail and 10-percent-thick wing, 8-percent-thick tail in Mach number range from 0.7 to 1.3. Brief comparison made between airplane and wing section lift-drag ratios.

NACA RM L9D08

ESTIMATED TRANSONIC FLYING QUALITIES OF A TAILLESS AIRPLANE BASED ON A MODEL INVESTIGATION. Charles J. Donlan and Richard E. Kuhn. June 8, 1949. 63p. diagrs., photos., tabs. (NACA RM L9D08)

An analysis of the estimated flying qualities of a tailless airplane with the wing quarter-chord line swept back 35°, an aspect ratio of 3, and taper ratio of 0.6 in the Mach number range from 0.40 to 0.91 has been made. The longitudinal stability and control were investigated and estimates made of the period and damping of the short-period longitudinal and lateral oscillations. Also included are the wind-tunnel test data on which the analysis is based. Data include longitudinal and lateral stability and control-force data, effect of speed brakes, canopies, fins, and wing-alone tests. Tuft studies of flow on wings, fins, and behind speed brakes are included throughout the Mach number range.

NACA RM L9J07a

INVESTIGATION OF THE DYNAMIC LATERAL STABILITY AND CONTROL CHARACTERISTICS OF A MODEL OF A FIGHTER AIRPLANE WITHOUT A HORIZONTAL TAIL AND EQUIPPED WITH EITHER SINGLE OR TWIN VERTICAL TAILS. John W. Draper and Robert W. Rose. November 15, 1949. 20p. diagrs., photos., tab. (NACA RM L9J07a)

An investigation has been conducted in the Langley free-flight tunnel to compare the lateral stability and control characteristics of a model of a fighter airplane without a horizontal tail and equipped either with a single vertical tail mounted on the fuselage or with twin vertical tails of the same tail volume mounted on the wing. The investigation included force and flight tests of the model with both tail configurations.

#NACA RM SL50B23, by Michal

#NACA RM SL50H23a, by Ulmann and Lord

NACA RM L50K03

INVESTIGATION OF THE AERODYNAMIC EFFECTS OF AN EXTERNAL STORE IN COMBINATION WITH 60° DELTA AND LOW-ASPECT-RATIO TAPERED WINGS AT A MACH NUMBER OF 1.9. Ellery B. May, Jr. January 9, 1951. 46p. diagrs., photos. (NACA RM L50K03)

A wind-tunnel investigation was made of an external store of fineness ratio 8.6 which was located on the chord plane of several wings in the Langley 9- by 12-inch supersonic blowdown tunnel. The work was carried out at a Mach number of 1.9 on wings having 60° leading-edge sweepback and unswept trailing edges with taper ratios of 0 and 0.28, and on an unswept wing having a taper ratio of 0.625. Investigation was made to determine the aerodynamic effects of store position, the loading breakdown between the store and the inner and outer wing panel of one wing, and the effects of the store on control characteristics. The test Reynolds numbers ranged between 2.3×10^6 and 4.0×10^6.

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NACA RM L50K16

WING-ON AND WING-OFF LONGITUDINAL CHARACTERISTICS OF AN AIRPLANE CONFIGURATION HAVING A THIN UNSWEPT TAPERED WING OF ASPECT RATIO 3, AS OBTAINED FROM ROCKET-PROPELLED MODELS AT MACH NUMBERS FROM 0.8 TO 1.4. Clarence L. Gillis and A. James Vitale. March 14, 1951. 52p. diagrs., photos., tabs. (NACA RM L50K16)

Flight tests were conducted on three rocket-propelled models of an airplane configuration, two models having thin unswept tapered wings of aspect ratio 3 and hexagonal airfoil sections, and the third having no wing. The two winged models had wings of different stiffness characteristics. Aerodynamic derivatives defining the static and dynamic longitudinal stability, control, trim, and drag characteristics of the configuration were obtained over a Mach number range from 0.8 to 1.4. For some of the aerodynamic derivatives the separate effects of the wing, tail, and fuselage were determined. Some buffeting and maximum lift information was obtained at high subsonic speeds.

NACA RM L51K05

TOTAL-PRESSURE RECOVERY OF A CIRCULAR UNDERSLUNG INLET WITH THREE DIFFERENT NOSE SHAPES AT A MACH NUMBER OF 1.42. Charles F. Merlet and Howard S. Carter. February 1952. 37p. diagrs., photos. (NACA RM L51K05)

Total-pressure recoveries at the inlet and after diffusion and shadowgraphs are presented for a circular underslung inlet located well forward on a body of revolution. Three nose shapes, varying in bluntness, were tested at three angles of attack and one angle of yaw in a free-air jet at a Mach number of 1.42, and over a range of mass-flow ratios from 0.3 to 0.9.

NACA RM L51K06

LONGITUDINAL STABILITY AND DRAG CHARACTERISTICS AT MACH NUMBERS FROM 0.75 TO 1.5 OF AN AIRPLANE CONFIGURATION HAVING A 60° SWEPT WING OF ASPECT RATIO 2.24 AS OBTAINED FROM ROCKET-PROPELLED MODELS. A. James Vitale, John C. McFall, Jr., and John D. Morrow. April 1952. 43p. diagrs., photos., tabs. (NACA RM L51K06)

Flight tests were conducted on a rocket-propelled airplane configuration model and on a drag model, each having a 60° swept wing of aspect ratio 2.24 with different fuselages. The longitudinal stability, control, and drag characteristics of the airplane configuration were determined over a Mach number range of 0.75 to 1.50. Wing-plus-interference minimum drag was obtained from the drag model over a Mach number range of 0.90 to 1.50. For some of the aerodynamic derivatives the separate effects of the wing, tail, and fuselage were obtained.

NACA RM L51K20

SUMMARY OF SOME EFFECTIVE AERODYNAMIC TWISTING-MOMENT COEFFICIENTS OF VARIOUS WING-CONTROL CONFIGURATIONS AT MACH NUMBERS FROM 0.6 TO 1.7 AS DETERMINED FROM ROCKET-POWERED MODELS. H. Kurt Strass. January 1952. 22p. diagrs., photo., 2 tabs. (NACA RM L51K20)

This paper presents a summary of some effective aerodynamic twisting-moment coefficients of various wing-control configurations at Mach numbers from 0.6 to 1.7 as determined by the use of rocket propelled test vehicles which indicated that, within the framework of the necessary assumptions, the value of the effective twisting-moment coefficient decreased as the sweepback of the aileron hinge axis is increased. Large changes in the value of the effective twisting-moment coefficient were obtained in the Mach number region from $M \approx 0.8$ to $M \approx 1.2$ with changes in aileron span and location upon the same wing plan form. Above $M \approx 1.2$, the values tended to agree more closely. This factor limits the use of these data to wing-control configurations similar to those tested. Comparative tests of an outboard 0.3-span, 0.25-chord aileron, and a midspan spoiler of approximately the same span length indicate that the twisting moment of the spoiler is about one-third that of the aileron for equal values of rolling effectiveness.

NACA RM L52K17

INVESTIGATION AT TRANSONIC SPEEDS OF A FORWARD-LOCATED UNDERSLUNG AIR INLET ON A BODY OF REVOLUTION. P. Kenneth Pierpont and John A. Braden. January 1953. 109p. diagrs., photos., tabs. (NACA RM L52K17)

Results are given for an experimental investigation of a forward-located underslung scoop mounted on a basic body at Mach numbers from 0.6 to 1.1 and for angles of attack from 0° to 10°. The inlet area was 17.3 percent of the body frontal area. For mass-flow ratios from 0.3 to within 5 percent of the maximum, total pressure recovery in the diffuser in excess of 97 percent was realized at all Mach numbers and angles of attack. External drag of the scoop model at high mass-flow condition was approximately equal to that of the basic body.

NACA RM L52K20a

EFFECTS OF SIZE OF EXTERNAL STORES ON THE AERODYNAMIC CHARACTERISTICS OF AN UNSWEPT AND A 45° SWEPTBACK WING OF ASPECT RATIO 4 AND A 60° DELTA WING AT MACH NUMBERS OF 1.41, 1.62, AND 1.96. Carl R. Jacobsen. January 1953. 55p. diagrs., photos., tab. (NACA RM L52K20a)

An investigation has been made in the Langley 9- by 12-inch supersonic blowdown tunnel to determine the effects of external stores of various sizes on the lift, drag, and pitching-moment characteristics of three wings; an unswept and a 45° sweptback wing having aspect ratios of 4 and taper ratios of 0.6, and a 60° delta wing at Mach numbers of 1.41, 1.62, and 1.96.

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The size of a Douglas Aircraft Company, Inc., store having a fineness ratio of 8.58 was systematically varied at the 80-percent-semispan station of the unswept and sweptback wing and at the 60-percent-semispan station of the delta wing. Several stores were also tested at various other store locations on the outer 60 percent of each of the wing semispans. For wing areas of 500, 600, and 750 square feet for an unswept, a sweptback, and a delta wing, respectively, the store sizes covered in the investigation provide data for stores ranging in size from a 200-pound bomb to a large jet engine nacelle.

NACA RM L52K21

EFFECT OF LEADING-EDGE CHORD-EXTENSIONS ON SUBSONIC AND TRANSONIC AERODYNAMIC CHARACTERISTICS OF THREE MODELS HAVING 45° SWEPTBACK WINGS OF ASPECT RATIO 4. Kenneth W. Goodson and Albert G. Few, Jr. January 1953. 31p. diagrs., photos., tab. (NACA RM L52K21)

This paper presents the effects of wing leading-edge chord-extensions on the subsonic and transonic high-lift pitching moment and the performance characteristics of three models having wings of 45° sweepback, aspect ratio 4, taper ratio 0.30, and NACA 65A006 airfoil sections parallel to the free stream. The test Reynolds numbers varied from about 0.6×10^6 to 3.25×10^6, depending upon the wing and Mach number. Some tests were made with a full-chord fence installed.

NACA RM L52K28

HINGE-MOMENT CHARACTERISTICS FOR SEVERAL TIP CONTROLS ON A 60° SWEPTBACK DELTA WING AT MACH NUMBER 1.61. K. R. Czarneckl and Douglas R. Lord. January 1953. 31p. diagrs., photos. (NACA RM L52K28)

An investigation has been made at a Mach number of 1.61 and a Reynolds number of 4.2×10^6 to determine the hinge-moment characteristics of a group of tip controls on a 60° sweptback delta wing. The control configurations varied in plan form and in amount of aerodynamic balance. Tests were made over an angle-of-attack range of 0° to 15° and a flap deflection range of -30° to 30°. A comparison of the experimental results with theory is included.

#NACA RM SL53H11, by Falanga

NACA RM L53K03

EFFECT OF LARGE DEFLECTIONS OF A CANARD CONTROL AND DEFLECTIONS OF A WING-TIP CONTROL ON THE STATIC-STABILITY AND INDUCED-ROLL CHARACTERISTICS OF A CRUCIFORM CANARD MISSILE AT A MACH NUMBER OF 2.01. M. Leroy Spearman. December 1953. 20p. diagrs., tabs. (NACA RM L53K03)

An investigation has been conducted in the Langley 4- by 4-foot supersonic pressure tunnel at a Mach number of 2.01 to determine the effect of large deflections of a canard and deflections of a wing-tip control on the static stability and induced-roll characteristics of a cruciform-wing canard-type missile. The missile had a body fineness ratio of 15.7. The tests covered an angle-of-attack range from 0° up to about 27°, a canard deflection range up to 30°, and a wing-tip control deflection up to 20°

NACA RM L53K11

EFFECTS OF A SERIES OF INBOARD PLAN-FORM MODIFICATIONS ON THE LONGITUDINAL CHARACTERISTICS OF TWO UNSWEPT WINGS OF ASPECT RATIO 3.5, TAPER RATIO 0.2, AND DIFFERENT THICKNESS DISTRIBUTIONS AT MACH NUMBERS OF 1.61 AND 2.01. John R. Sevier, Jr. February 1954. 43p. diagrs., photos. (NACA RM L53K11)

Tests of a series of inboard plan-form modifications of two unswept wings of aspect ratio 3.5 and taper ratio 0.2 were made at the Langley 4- by 4-foot supersonic pressure tunnel at Mach numbers of 1.61 and 2.01. Results indicated that, by properly modifying the wing thickness and plan form, significant increases in wing volume can be attained with little or no penalties in drag and actual increases in maximum lift-drag ratio.

NACA RM L53K27

WIND-TUNNEL INVESTIGATIONS AT LOW AND TRANSONIC SPEEDS OF THE FEASIBILITY OF SELF-ACTUATING SPOILERS AS A LATERAL-CONTROL DEVICE FOR A MISSILE. Harleth G. Wiley and William C. Hayes, Jr. January 1954. 24p. diagrs., tab. (NACA RM L53K27)

Results are presented of wind-tunnel investigations of the lateral-control effectiveness of self-actuating spoilers on a thin 60° delta wing up to an angle of attack of about 20° at low speeds and of the aerodynamic moments acting on an isolated self-actuating spoiler through an angle-of-rotation range of 180° at transonic speeds. Presented also are the results of brief tests of spoiler actuating times at low speeds.

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NACA RM L54K02

A LIMITED FLIGHT INVESTIGATION OF THE EFFECT OF DYNAMIC VIBRATION ABSORBERS ON THE RESPONSE OF AN AIRPLANE STRUCTURE DURING BUFFETING. Jim Rogers Thompson and John E. Yeates, Jr. January 1955. 29p. diagrs., photos. (NACA RM L54K02)

Limited flight measurements have been made in the high-speed low-lift buffet region of the effect on the buffeting response of dynamic vibration absorbers mounted on the wing tips. The absorbers had 70-pound-moving weights and greatly reduced the response in the tuned mode. Approximate calculations indicated that significant reductions could be produced by an installation weighing considerably less than that tested. The device shows promise both as a buffet alleviator and as a research instrument.

NACA RM L54K11a

EXPERIMENTAL AERODYNAMIC FORCES AND MOMENTS AT LOW SPEED OF A MISSILE MODEL DURING SIMULATED LAUNCHING FROM THE MIDSEMISPAN LOCATION OF A 45° SWEPTBACK WING-FUSELAGE COMBINATION. William J. Alford, Jr., H. Norman Silvers, and Thomas J. King, Jr. February 1955. 36p. diagrs., photo., tabs. (NACA RM L54K11a)

An investigation was made at low speed in the Langley 300-mph 7- by 10-foot tunnel to determine the aerodynamic forces and moments of a missile model during simulated launching from the mid-semispan location of a 45° sweptback wing-fuselage combination. Various chordwise and vertical locations were investigated with and without a flat-sided pylon installed. The angle-of-attack range generally extended from -8° to 28°.

NACA RM L54K12

TRANSONIC LONGITUDINAL AERODYNAMIC EFFECTS OF SWEEPING UP THE REAR OF THE FUSELAGE OF A ROCKET-PROPELLED AIRPLANE MODEL HAVING NO HORIZONTAL TAIL. James H. Parks. January 1955. 30p. diagrs., photo. (NACA RM L54K12)

The transonic longitudinal aerodynamic effects of sweeping up the rear of the fuselage have been investigated in free flight by using rocket-propelled models having no horizontal tails. The models had aspect-ratio-4 wings with both the wings and vertical tails swept back 45°. Static and dynamic longitudinal stability parameters, trim conditions, drag at trim lift, and local downflow values are presented.

NACA RM L54K15a

A THEORETICAL INVESTIGATION OF THE EFFECT OF AUXILIARY DAMPING ON THE LONGITUDINAL RESPONSE OF A TRANSONIC BOMBER CONFIGURATION IN FLIGHT THROUGH CONTINUOUS TURBULENCE. T. F. Bridgland, Jr. March 1955. 26p. diagrs., tab. (NACA RM L54K15a)

A theoretical investigation has been made of the effects of auxiliary pitch-rate damping on the longitudinal response of a transonic bomber configuration in low-altitude flight through continuous rough air. The methods of generalized harmonic analysis are utilized in obtaining the statistical character of the airframe responses to a random gust velocity input. The results of this investigation indicate that, for the airframe and speed range considered, reductions in root-mean-square normal acceleration of about 24 percent and reductions in root-mean-square pitch angle of about 74 percent are possible through the use of auxiliary pitch-rate damping.

NACA RM L54K30

FREE-FLIGHT INVESTIGATION, INCLUDING SOME EFFECTS OF WING AEROELASTICITY, OF THE ROLLING EFFECTIVENESS OF AN ALL-MOVABLE HORIZONTAL TAIL WITH DIFFERENTIAL INCIDENCE AT MACH NUMBERS FROM 0.6 TO 1.5. Roland D. English. January 1955. 11p. diagrs., photo. (NACA RM L54K30)

A free-flight investigation has been made to determine the rolling effectiveness at zero angle of attack of an all-movable horizontal tail at a constant angle of differential incidence of 7° per fin mounted behind a notched delta wing over a Mach number range from 0.6 to 1.5. Two models were tested, one with a stiff wing and one with a flexible wing. The rolling effectiveness of both models was of about the same magnitude at subsonic and supersonic speeds. The rolling effectiveness of the flexible-wing model was about 1.6 times that of the stiff-wing model except in the transonic region.

NACA RM L55A24

FLIGHT AND PREFLIGHT TESTS OF A RAM JET BURNING MAGNESIUM SLURRY FUEL AND UTILIZING A SOLID-PROPELLANT GAS GENERATOR FOR FUEL EXPULSION. Walter A. Bartlett, Jr., and William K. Hagginbothom, Jr. April 1955. 35p. diagrs., photos. (NACA RM L55A24)

Data obtained from the first flight test of a ram jet utilizing a magnesium slurry fuel are presented. The ram jet accelerated from a Mach number of 1.75 to a Mach number of 3.48 in 15.5 seconds. During this period a maximum acceleration of 4.6g was obtained. Maximum values of air specific impulse and gross thrust coefficient were calculated to be 151 seconds and 0.658, respectively. The rocket gas generator used as a fuel-pumping system operated successfully.

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NACA RM L55K09

WIND-TUNNEL INVESTIGATION AT TRANSONIC SPEEDS OF A JET CONTROL ON A 35° SWEPT WING. TRANSONIC-BUMP METHOD. Raymond D. Vogler and Thomas R. Turner. February 1956. 17p. diagrs. (NACA RM L55K09)

Results are presented of a wind-tunnel investigation at transonic speeds and at angles of attack of -4° to 16° to determine the characteristics of a jet control on a 35° swept-semispan wing. The control consisted of numerous holes normal to the wing surface located on the 65-percent chord line and extending in a spanwise direction from 0.133 to 0.70 of the semispan. Force and moment data were obtained by using ejected air with pressure ratios as high as 9.7 to 1 between the total pressure in the jets and free-stream static pressure.

NACA RM L55K11

EXPERIMENTAL INVESTIGATION AT HIGH SUBSONIC SPEED OF THE ROLLING STABILITY DERIVATIVES OF A COMPLETE MODEL HAVING A CLIPPED-DELTA WING AND A HIGH HORIZONTAL TAIL. William C. Sleeman, Jr., and Albert G. Few, Jr. February 1956. 32p. diagrs., tab. (NACA RM L55K11)

Rolling-stability derivatives are presented for a complete model having an aspect-ratio-3 clipped-delta wing and a high horizontal tail for a Mach number range of 0.60 to 0.92 and for an angle-of-attack range from 0° to a maximum of 13° for the lower Mach numbers. The wing and delta plan-form horizontal tail were swept back 45° at the leading edge and had NACA 65A006 airfoil sections. Breakdown tests were made to determine contributions of the various component parts to the rolling-stability derivatives.

NACA RM L56C06

PREFLIGHT AND FLIGHT-TEST INVESTIGATION OF A 50-PERCENT-MAGNESIUM 50-PERCENT JP-4 SLURRY FUEL IN A TWIN-ENGINE RAM-JET VEHICLE. Otto F. Trout, Jr., and Thomas L. Kennedy. May 1956. 27p. diagrs., photos. (NACA RM L56C06)

Performance data obtained from the preflight and flight tests of a 50-percent-magnesium 50-percent JP-4 slurry fuel are presented. Using this fuel, the ram-jet vehicle accelerated from a Mach number of 2.23 to 2.56 while climbing from an altitude of 3,320 to 37,940 feet. Data are presented for the values of air specific impulse and gross thrust coefficients over the range of altitudes tested.

NACA RM L56I24a

FLIGHT INVESTIGATION OF A RAM JET BURNING MAGNESIUM SLURRY FUEL AND HAVING A CONICAL SHOCK INLET DESIGNED FOR A MACH NUMBER OF 4.1. Walter A. Bartlett, Jr., and Charles F. Merlet. January 1957. 23p. diagrs., photos. (NACA RM L56I24a)

A ram-jet vehicle having a conical shock inlet diffuser designed for a Mach number of 4.1 and utilizing a magnesium slurry fuel was tested in free flight. Data are presented which show that the vehicle accelerated from a Mach number of 1.73 to a maximum Mach number of 3.84 in 13.2 seconds. During this period a maximum acceleration of 6.1g was measured. Maximum values of air specific impulse of 150 seconds and gross thrust coefficient of 0.76 were calculated.

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